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Dr. Itzhak Jacoby

PI - Signature Date

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Domestic Use of Telemedicine Technology: Lessons Learned From Initial Consultations

INTRODUCTION:

Twenty-one patients presenting to the Dunham U.S. Army Health Clinic (DUSAHC) were evaluated by specialists at Walter Reed Army Medical Center (WRAMC) between June 1-30, 1995, using videoconferencing technology (Telemedicine). The project involved DUSAHC physicians and physicians' assistants, consulting physicians at WRAMC, Mystech computer system developers, WRAMC support staff, DUSAHC support staff, and a data gatherer from the Uniformed Services University of the Health Sciences (USUHS).

Project Initiation:

Telemedicine equipment (Sun workstations with conferencing software and diagnostic peripherals) had been installed at the DUSAHC (Carlisle) site in February 1995. After one unsatisfactory attempt at a teleconsult on February 27, this equipment lay dormant.

Following a May 19 meeting with the medical staff of DUSAHC (during Grand Rounds), telemedicine consults began to be scheduled almost daily, often twice a day. During that meeting the project priority, equipment capabilities and mission expectations were explained by telemedicine representatives from WRAMC and Fort Detrick, and clinic staff were promised resources to aid in the initiation of a teleconsulting program. Three major points were agreed upon at that meeting: consults would be scheduled at the clinic's convenience, with WRAMC staff making themselves available on a flexible basis; a Mystech programmer would be assigned to work at the clinic to debug and operate the equipment during consults; and those telemedicine patients requiring follow-up appointments would have them scheduled either during the consult or on an expedited basis. The Carlisle medical staff, in turn, made a commitment to use telemedicine consultations.

Consultations were begun in June for a one-month trial of the telemedicine consultation process. A total of 21 consultative sessions took place, involving several referring clinicians, consulting specialists, and patients. Below is a subjective assessment of that trial with recommendations.

Problems encountered:

Several reasons for non-use of the equipment which had been in place for more than three months were given by Carlisle staff. They were not trained to use the equipment and found it intimidating, and staff perceived the WRAMC consultants as condescending. In addition, an initial trial on a potential tonsillectomy proved time consuming and nonproductive, as surgery was not scheduled. DUSAHC staff found scheduling the consultation and an equipment technician problematic. None of these problems are insurmountable: consultants suggested that designated days for specialty services need to be established, if possible. In addition, they suggested that service chiefs should establish whether there will be a designated telemedicine consultant physician from their staff or whether the individual on call will be expected to respond to all telemedicine consults; this should facilitate scheduling.

In addition, the project suffered from lack of coordination. A coordinator with sufficient time and commitment to telemedicine would be a major asset. One nurse was designated point of contact at DUSAHC and trained by Mystech to run the system; however, telemedicine was a low priority in her long list of other duties, and shortly after being given this duty, she took a lengthy leave. A physical therapist who already had a full clinical schedule was taught to use the software, but never gained sufficient skill with it to make the intricate adjustments the equipment required. It should be noted that this particular stumbling block may no longer be an issue; technicians assert that now such adjustments are required only on system set-up or when the system is altered, rather than on every use. Nonetheless, this contributed to limited use of the system and to few potential teleconsults being scheduled.

INFRASTRUCTURE:

Personnel

The DUSAHC trial indicated that a designated telemedicine coordinator with specific skills is an absolute requirement. Because telemedicine represents an interface between clinical medicine consultation and state-of-the-art video teleconferencing technology, the telemedicine trial involved a diverse group of individuals: physicians, clinic support staff, software developers, and hardware technicians. While the plan was to have one central person manage scheduling, it became evident in the course of the month with the turnover of the designated coordinator that this role is key to the success of a telemedicine program. In addition, it was clear that such a person must have a major time commitment to this coordination role.

Communication skills are a crucial attribute of the coordinator, since this person will be facilitating interactions among professionals and support staff with varied backgrounds, jargons, and expertise. In addition, organizational ability is essential; the coordinator is responsible for anticipating details of the consultation process, managing the flow of work required in set-up and in the actual process, keeping accurate records of the consultations, and generally keeping the entire process moving smoothly. The coordinator must be sensitive to both the needs of clinicians in maintaining standard clinical procedures and the needs of computer technicians whose major concerns are the equipment and software; the coordinator must keep both sides of the show running smoothly. A basic clinical knowledge is required in order for the coordinator to understand the consult documents and anticipate what peripheral equipment, such as x-ray and other medical equipment, might be required to interface with the computer technology in order for the consultation to take place.

Equipment

Installation of equipment should be a self-contained operation, not requiring the host facilities' resources, with the exception of a dedicated phone line and fax machine which can reasonably be expected to be provided by the clinic.

Ideally, telemedicine hardware, software, and communication links should be debugged and tested on site so as to be fully functional prior to scheduling patients. This should reduce the need for multiple support staff and technicians on site for individual consults, and would reduce the cost of

these consults. However, it must be remembered that telemedicine is a state-of-the-art testbed for an immature technology; the technology is evolving, and requires relatively constant supervision as it continues to be modified to improve the system's functionality.

Based on the experience of this one month trial, a list of technical audio and video requirements was developed.

Audio: High quality voice transmission is essential. The patient's medical history is taken orally by the consultant with input from both the patient and referring medical officer; the microphone must easily pick up at least two individuals speaking at normal volume from a distance of approximately five feet. In addition, patient and clinician may change position or location during the examination; the sound system should allow for normal motion. In addition, transmission of low frequency sounds is important; consulting specialists commented that they could not hear breath sounds adequately, which could be crucial to the medical consult. The system should be calibrated ahead of time, and every effort should be made to avoid the need for ongoing adjustment during the consultation session.

Mystech technicians report that the sound system has been substantially improved over that used for the test, with better technology for handling audio input, including echo canceling and automatic gain control, to handle loud and soft voices equally well.

Video: The video signal needs to transmit continuous motion images, particularly of the patient during examination. The patient's body language is also important during history taking and clinician-patient interaction. Two way video, where both parties simultaneously see each other as well the picture that they are transmitting, facilitates the interaction. The system should not require continuous fine-tuning during a consultation. During the DUSAHC one-month trial, motion artefact often made assessment difficult; better resolution is recommended for optimal assessment.

During the month long trial, a remote control video with zoom feature at the referring location proved extremely useful. It allowed the consultant to see both the patient and the referring doctor; but more importantly, it enhanced the physical examination. Individual physical characteristics, such as rashes or skin lesions, were able to be visualized both closeup and within the context of their location on the body; stethoscope placements were able to be guided by the consultant long-distance during cardiac consults; and radiological images placed on a light box were transmitted. While a monitor-mounted video camera was adequate for the consultant station, it is optimal to have a moveable camera to follow the patient through changes of position.

Currently, two-way video technology is continuously available at Carlisle, and could be easily made available at WRAMC. In addition, a new computer has solved some of the problems experienced which required ongoing fine-tuning or adjustments. Thus the potential for future success is enhanced. However, backup software and technical support should be readily available in any current telemedicine clinic.

PRELIMINARY DATA:
Data on each teleconsult were collected from the consult request form, consultant response form, and the consultant's after-action report. A list of evaluation questions was devised, and additional data were obtained from an observer's notes taken during the consultation. Eight telemedicine consultations were observed at the Carlisle location and ten at WRAMC. Some basic information on the 21 telemedicine consultation sessions of this one-month trial are presented below.

Profile of Cases:
Physicians providing consults represented eight specialty areas. Of the 21 consults provided, nearly half (48%; n=10) were in dermatology. In addition, two consults were requested for otorhinolaryngology, pediatric cardiology, adult cardiology, and gastroenterology. One consult each was requested for internal medicine, rheumatology, and pulmonary medicine.

The majority of cases were referred by family practitioners (8 cases; 38%) and physician's assistants (9 cases; 43%). In addition, three cases (14%) were referred by pediatricians and one case was referred by a gastroenterologist. Nearly half of the cases (48%) was active duty military; the remaining eleven cases were nearly evenly split between retired military persons (6; 28%) and family members of active duty personnel (5; 24%). Consultation sessions on average lasted about 23 minutes; the briefest took only five minutes, and the longest was 50 minutes. One fourth of the cases (5 of 21) was scheduled for follow-up at WRAMC. Further follow-up analysis has not yet been done.

Peripheral Equipment:
In addition to the standard telemedicine equipment, certain pieces of peripheral equipment were required for specific consultation sessions. This equipment had to be scheduled and set up in advance for those particular sessions, underlining the need for coordination and advance planning. The peripherals used included a dermoscope for the ten dermatology consults, a stethoscope for four of the sessions, and an otoscope for one session. Six of the 21 sessions (28%) required no additional equipment.

Subjective Assessment:
While a thorough evaluation cannot be made given the limited data available on the several telemedicine consults that comprised this trial, some findings can be reported and some recommendations made.

Overall, patients and physicians requesting the consults expressed satisfaction with the telemedicine consultations between DUSAHC and WRAMC. Since the equipment is in place and becoming a familiar adjunct to medical practice, it is recommended that the consultations continue.

The one month trial was stressful for support personnel, who were not adequately prepared for the volume and nature of the work the project generated. To alleviate the need for repeated searches for consultants at WRAMC, specialty providers should be polled for their optimum

telemedicine consult times, or each service should assign specialists on a rotating basis to cover consults. It is possible that e-mail could be used effectively for scheduling, to circumvent problems often encountered in trying to schedule in busy clinics with limited support staff.

A departmental meeting at the Carlisle clinic was held to report the results of the telemedicine consult trial, review the staff's collective contribution, gather information on participants' level of satisfaction with the process, and hear their suggestions for improving the process. Similar meetings with consultants at the consulting tertiary care center (WRAMC, in this case) might prove useful in improving the telemedicine consultation process.

The paperflow required appeared to be excessive; records of each consult were kept at both sites. A more efficient workflow and record-keeping procedure should be developed. If electronic records were established which could be accessed from both facilities, paperwork and the redundancy of duplicate records could be reduced.

CONCLUSIONS:

The test of the process was at least a limited success. As the DUSAHC practitioners had positive experiences and became accustomed to having the consults available, they began to request a broader range of subspecialty consults. During the one-month trial, the attitude toward teleconsults shifted from apprehension to expectation. Clinic staff's request that teleconsulting continue after the trial period testifies that the technology has been accepted and integrated into standard clinical practice. The Carlisle clinic commander was pleased with the trial, and saw telemedicine as having some unique advantages in offering subspecialty consultation.

Technologically, it is possible to do effective routine telemedicine consultations which seem to be highly satisfactory for the patient, the consultant, and the referring physician. Adequate evaluation of the cost-effectiveness and long-term health outcome of the consultation is problematic, however. This is primarily due to the lack of an adequate data collection instrument. Ideally, a database should be established, with input on past medical history, current illness or presenting complaint, findings of the consultation, and subsequent interventions. In addition, quantitative data such as the number of patient-physician encounters, time required for set-up and scheduling, costs incurred, etc. should be obtained. Patient satisfaction information could also be included in the database. With sufficient data methodically collected, an evaluation of telemedicine as compared to other approaches could be performed. Of course such comparisons would be possible only if comparable data are available on standard approaches.

RECOMMENDATIONS:

The Carlisle site is an excellent laboratory for continued evaluation, development and refinement of evaluation instruments for several reasons: It has an accessible location with equipment already in place, a supportive and enthusiastic staff, cooperative physicians, and preliminary data. Based on these preliminary data, suggestions for improvement of the current evaluations instruments can be made.

1. The data collection form is not in an optimal format. It attempted to capture too many variables, and lacked specificity. The format is not optimal; an electronic database with a customized screen presenting a checklist with a memo field for additional text entry for each major question would allow standardized data collection.

2. Results of the consult (diagnosis and outcomes) could be a separate but related data entry field. A generic list could be developed or adapted from an existing list, such as the ICD or DRG codes, to allow for a checklist approach to data collection on diagnoses and recommended interventions.

3. A standard format for after-action consult reports should be developed and tested, incorporating the information entered in the results data screen and generated automatically by the electronic system; a memo screen for additional comments could be incorporated in the results screen to allow for unique data not covered by the checklists.

4. The electronic system should include a "tickler" system for follow-up on actions taken by referring physicians based on the consultations.

5. Assuming continuation of the telemedicine trial program at the Carlisle clinic, program evaluation should incorporate six and twelve month follow-ups on each consult to obtain patient attitude/satisfaction data.

6. Finally, based on the information obtained to date on 21 cases, some preliminary assessments could be made regarding cost-effectiveness of the telemedicine consults. Comparisons can be made between these cases and data available from the medical records of similar cases handled in the routine manner at the clinic (i.e. without telemedicine technology) during the same time period.